HEWLETT PACKARD

MSA-0200
MODAMP™ Cascadable Silicon Bipolar Monolithic Microwave Integrated Circuit Amplifiers

Features

- **Cascadable 50 Ω Gain Block**
- **3 dB Bandwidth: DC to 2.8 GHz**
- **12.0 dB typical Gain at 1.0 GHz**
- **Unconditionally Stable (k>1)**

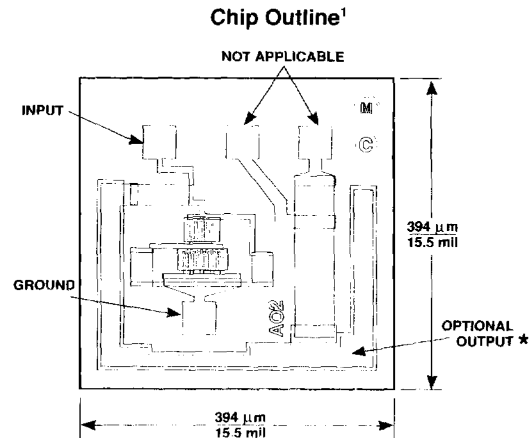
Description

The MSA-0200 is a high performance silicon bipolar Monolithic Microwave Integrated Circuit (MMIC) chip. This MODAMP™ MMIC is designed for use as a general purpose 50 Ω gain block. Typical applications include narrow and broad band IF and RF amplifiers in commercial, industrial and military applications.

The MODAMP MSA-series is fabricated using a 10 GHz f_T, 25 GHz f_{MAX} silicon bipolar MMIC process which utilizes nitride self-alignment, ion implantation and gold metallization to achieve excellent uniformity, performance, and reliability. The use of an external bias resistor for temperature and current stability also allows bias flexibility.

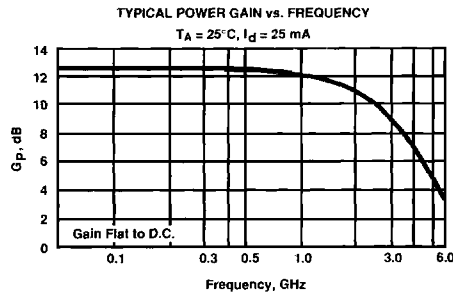
The recommended assembly procedure is gold-eutectic die attach at 400°C and either wedge or ball bonding using 0.7 mil gold wire. See APPLICATIONS section, "Chip Use".

Chip Outline[1]

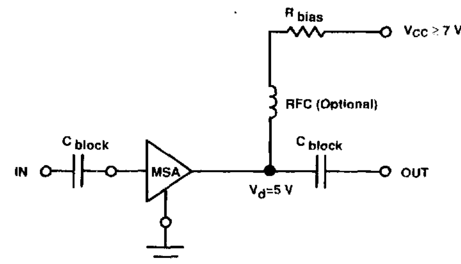


Unless otherwise specified, tolerances are ±13 μm / ±0.5 mils.
Chip thickness is 114 μm / 4.5 mil. Bond pads are 41 μm / 1.6 mil typical on each side.
* Output contact is made by die attaching the backside of the die.

TYPICAL POWER GAIN vs. FREQUENCY
$T_A = 25°C$, $I_d = 25$ mA



Typical Biasing Configuration



Electrical Specifications[2], $T_A = 25°C$

Symbol	Parameters and Test Conditions[3]: $I_d = 25$ mA, $Z_O = 50\ \Omega$		Units	Min.	Typ.	Max.
G_P	Power Gain ($\lvert S_{21}\rvert^2$)	f = 0.1 GHz	dB		12.5	
ΔG_P	Gain Flatness	f = 0.1 to 1.8 GHz	dB		±0.6	
$f_{3\ dB}$	3 dB Bandwidth		GHz		2.8	
VSWR	Input VSWR	f = 0.1 to 3.0 GHz			1.4:1	
	Output VSWR	f = 0.1 to 3.0 GHz			1.4:1	
$P_{1\ dB}$	Output Power @ 1 dB Gain Compression	f = 1.0 GHz	dBm		4.5	
NF	50 Ω Noise Figure	f = 1.0 GHz	dB		6.5	
IP_3	Third Order Intercept Point	f = 1.0 GHz	dBm		17.0	
t_D	Group Delay	f = 1.0 GHz	psec.		125	
V_d	Device Voltage		V	4.5	5.0	5.5
dV/dT	Device Voltage Temperature Coefficient		mV/°C		-8.0	

Notes: 1. This chip contains additional biasing options. The performance specified applies only to the bias option whose bond pads are indicated on the chip outline. Refer to the APPLICATIONS section "MODAMP™ Silicon MMIC Chip Use" for additional information.
2. The recommended operating current range for this device is 18 mA to 40 mA. Typical performance as a function of current is on the following page.
3. RF performance of the chip is determined by packaging and testing 10 devices per wafer in a dual ground configuration.

Absolute Maximum Ratings

Parameter	Absolute Maximum[1]
Device Current	60 mA
Power Dissipation[2,3]	325 mW
RF Input Power	+13 dBm
Junction Temperature	200°C
Storage Temperature	–65°C to 200°C

Thermal Resistance[2,4]: θ_{jc} = 35°C/W

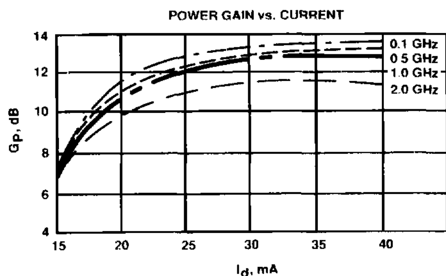
Notes:
1. Permanent damage may occur if any of these limits are exceeded.
2. $T_{MOUNTING\ SURFACE}$ = 25°C
3. Derate at 28.6 mW/°C for $T_{MOUNTING\ SURFACE}$ > 189°C.
4. The small spot size of this technique results in a higher, though more accurate determination of θ_{jc} than do alternate methods. See MEASUREMENTS section "Thermal Resistance" for more information.

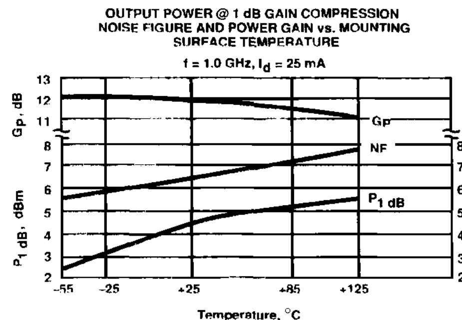
Part Number Ordering Information

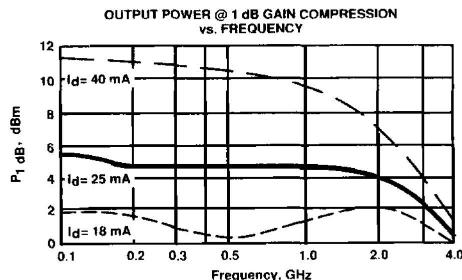
Part Number	Devices Per Tray
MSA-0200-GP2	10
MSA-0200-GP4	100
MSA-0200-GP6	up to 300

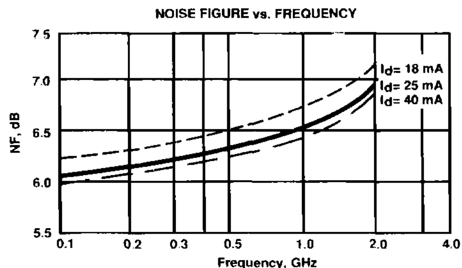
Typical Performance, T_A = 25°C

(unless otherwise noted)









Typical Scattering Parameters[4]: Z_O = 50 Ω — T_A = 25°C, I_d = 25 mA

Freq. GHz	S11 Mag	S11 Ang	S21 dB	S21 Mag	S21 Ang	S12 dB	S12 Mag	S12 Ang	S22 Mag	S22 Ang
0.1	.11	179	12.6	4.27	177	–18.4	.120	1	.11	–7
0.2	.11	174	12.6	4.26	172	–18.6	.117	4	.11	–12
0.4	.10	170	12.5	4.24	165	–18.4	.120	5	.12	–25
0.6	.09	166	12.5	4.22	158	–18.2	.123	7	.13	–38
0.8	.08	162	12.4	4.17	152	–18.2	.123	10	.13	–47
1.0	.06	161	12.3	4.13	144	–18.0	.126	13	.14	–55
1.5	.02	–170	12.0	3.99	126	–17.3	.137	17	.15	–72
2.0	.05	–105	11.5	3.74	109	–16.4	.152	20	.15	–89
2.5	.10	–103	10.8	3.46	97	–15.8	.163	25	.13	–91
3.0	.17	–124	9.8	3.10	83	–15.3	.172	26	.11	–100
3.5	.22	–137	8.7	2.71	68	–14.7	.184	22	.13	–94
4.0	.26	–144	7.4	2.35	55	–14.3	.192	22	.16	–85
5.0	.29	–165	5.1	1.80	35	–13.8	.203	17	.22	–76
6.0	.33	162	3.3	1.46	20	–13.5	.211	14	.23	–82

Note: 4. S-parameters are de-embedded from 70 mil package measured data using the package model found in the DEVICE MODELS section.